

## SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT WE, Toru Okawa, a citizen of Japan residing at c/o FUJITSU LIMITED, 1-1, Kamikodanaka 4-chome, Nakahara-ku, Kawasaki-shi, Kanagawa, 211 Japan, Ryuichi Matsukura, a citizen of Japan residing at c/o FUJITSU LIMITED, 1-1, Kamikodanaka 4-chome, Nakahara-ku, Kawasaki-shi, Kanagawa, 211 Japan and Yasuo Sato, a citizen of Japan residing at c/o FUJITSU LIMITED, 1-1, Kamikodanaka 4-chome, Nakahara-ku, Kawasaki-shi, Kanagawa, 211 Japan have invented certain new and useful improvements in

DISPLAY CONTROL SYSTEM CAUSING IMAGE ON DISPLAY SCREEN TO  
DISAPPEAR AND REAPPEAR IN A FRIENDLY MANNER TO USER

of which the following is a specification : -

1     TITLE OF THE INVENTION

          DISPLAY CONTROL SYSTEM CAUSING IMAGE ON  
DISPLAY SCREEN TO DISAPPEAR AND REAPPEAR IN A FRIENDLY  
MANNER TO USER

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BACKGROUND OF THE INVENTION

          (1) Field of the Invention

          The present invention generally relates to a  
display control system which is constituted in a data  
10     processing apparatus, such as a portable remote  
computer terminal or a general purpose computer, and  
more particularly to a display control system which  
causes an image on a display screen to disappear and  
reappear in a friendly manner to a user.

15       (2) Description of the Related Art

          In recent years, persons who are not  
specialists in computer technology have started using  
computers (data processing apparatuses). It is  
desirable that not only functions and performance of  
20     the computers be improved but also that users who are  
not specialists in the computer technology can enjoy  
using the computers.

          In conventional computers, a high importance  
is placed on improving functions and performance. For  
25     example, in a case of a process for making data (e.g.,  
character images and/or graphical images) on a display  
screen disappear, attention is mainly paid to how the  
data can disappear from the display screen at a high  
speed and by use of a small amount of software. In a  
30     case of a process for selecting a menu item from a  
menu shown on a display screen, our attention is  
mainly paid to how the menu item can be selected at a  
high speed and by use of a small amount of software.

          However, according to the conventional  
35     developing concept for the computers as described  
above, although the functions and performance of the  
computers can be improved, the computers are not

1 necessarily friendly machines to users.

Thus, the applicant has proposed a data processing apparatus in which data disappears from and reappears on a display screen in a friendly manner.

5 In this data processing apparatus, data (character images and/or graphical images) convergently disappear from the display screen like water being sucked by an aspirator and radially or spirally appear on the display screen like water welling up.

10 It is desirable that an appearance and disappearance manner of the data on the display screen be more friendly to users.

In addition, it is desirable that menu items can be displayed on a limited area of the display screen so as to be easily selected by a user.

#### SUMMARY OF THE INVENTION

Accordingly, a general object of the present invention is to provide a novel and useful display control system in which the disadvantages of the

20 aforementioned prior art are eliminated.  
A specific object of the present invention is to provide a display control system which can cause data (e.g., character images and/or graphical images) on a display screen to gradually disappear and

25 reappear in more friendly manners to users.  
The above objects of the present invention are achieved by a display control system for controlling data which is displayed on a screen of a display unit, the system comprising: pointing means for pointing to a position on the screen of the display unit; deleting means for gradually deleting elements of data from the screen of the display unit as if the elements were gradually being sucked at the

30 position pointed to by the pointing means; and density control means for controlling the density of elements remaining on the screen of the display unit so that

1 the density is gradually decreased in accordance with  
suction of the elements.

The above objects of the present invention  
are also achieved by a display control system for  
5 controlling data which is displayed on a screen of a  
display unit, the system comprising: pointing means  
for pointing to a position on the screen of the  
display unit; deleting means for gradually deleting  
elements of data from the screen of the display unit  
10 as if the elements were gradually being sucked at the  
position pointed to by the pointing means; and speed  
control means for controlling a speed at which the  
elements are gradually deleted so that the speed is  
gradually increased in accordance with suction of the  
15 elements.

The above objects of the present invention  
are also achieved by a display control system for  
controlling data which is displayed on a screen of a  
display unit, the system comprising: pointing means  
20 for pointing to a position on the screen of the  
display unit; restoring means for gradually restoring  
elements of data on the screen of the display unit as  
if the elements were welling up from the position  
pointed to by the pointing means; and density control  
25 means for controlling the density of elements restored  
on the screen of the display unit so that the density  
is gradually increased in accordance with appearance  
of the elements.

The above objects of the present invention  
30 are also achieved by a display control system for  
controlling data which is displayed on a screen of a  
display unit, the system comprising: pointing means  
for pointing to a position on the screen of the  
display unit; restoring means for gradually restoring  
35 elements of data on the screen of the display unit as  
if the elements were welling up from the position  
pointed to by the pointing means; and speed control

1 means for controlling a speed at which the elements  
are gradually restored so that the speed is gradually  
decreased in accordance with appearance of the  
elements.

5 According to the present invention, while  
the elements of the data are being gradually deleted  
and restored, the density of the elements or the speed  
at which the elements are deleted are controlled. As  
a result, the elements of the data can be gradually  
10 deleted from the screen of the display unit as if the  
elements were being sucked at the position pointed to  
(pointed position) more realistically, and the  
elements of the data can be gradually restored on the  
screen of the display unit as if the elements were  
15 welling up from the pointed position more  
realistically. Thus, data can disappear from and  
reappear on the screen on the display unit in a manner  
more friendly to a user.

Another object of the present invention is  
20 to provide a data processing apparatus in which menu  
items can be displayed on a limited area of the  
display screen so as to be easily selected by a user.

This object of the present invention is  
achieved by a data processing apparatus in which a  
25 process corresponding to a menu item selected from  
menu items displayed on a screen of a display unit is  
executed, comprising: pointing means for pointing to a  
menu on the screen of the display unit; control means  
for, in response to a pointing operation of the  
30 pointing means, causing menu items included in the  
menu pointed to by the pointing means to be display at  
a position on the screen of the display unit one by  
one in turns at predetermined intervals; detecting  
means for detecting a predetermined operation; and  
35 selecting means for selecting, as a menu item to be  
activated, a menu item displayed on the screen of the  
display unit when the detecting means detects the

1 predetermined operation.

According to the present invention, menu items included in a pointed menu are displayed one by one in turns at predetermined interval on the screen of the display unit. That is, all the menu items which can be selected are not simultaneously displayed on the screen of the display unit. A menu item which is displayed when the predetermined operation is performed is then selected. Thus, menu items can be displayed on a limited area of the display screen so as to be easy to be selected by a user.

#### BRIEF DESCRIPTION OF THE DRAWINGS

15 Other objects, features and advantages of the present invention will be apparent from the following description when read in conjunction with the accompanying drawings, in which:

Fig. 1 is a functional block diagram illustrating a data processing apparatus including a display control system according to a first embodiment of the present invention;

Fig. 2 is a block diagram illustrating an example of a hardware constitution of the data processing apparatus according to the first embodiment of the present invention;

Fig. 3 is a flowchart illustrating a process for deleting data from a display screen;

Figs. 4A and 4B are diagrams illustrating an example of movement of elements of data which are being deleted from the display screen;

Fig. 5 is a diagram illustrating a point into which elements of data should be convergently sucked in the process for deleting the data;

Fig. 6 is a diagram illustrating another example of movement of elements of data which are being deleted from the display screen;

1           Fig. 7 is a flowchart illustrating a process  
for restoring data on the display screen;

          Fig. 8 is a flowchart illustrating a process  
for controlling a speed at which the data is deleted;

5           Fig. 9 is a flowchart illustrating a process  
for controlling a speed at which the data is restored;

          Fig. 10 is a functional block diagram  
illustrating a data processing apparatus including a  
display control system according to a second  
10          embodiment of the present invention;

          Fig. 11 is a block diagram illustrating an  
example of a hardware constitution of the data  
processing apparatus according to the second  
embodiment of the present invention;

15          Fig. 12 is a flowchart illustrating a  
process for displaying menu items; and

          Fig. 13 is a diagram illustrating a menu bar  
and menu items which are displayed on a display  
screen.

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#### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

          A description will now be given of a first  
embodiment of the present invention.

          A data processing apparatus according to the  
25          first embodiment of the present invention is  
functionally formed as shown in Fig. 1. Referring to  
Fig. 1, the data processing apparatus 1 has a display  
unit 50, a pointing device 51 and a keyboard 52. The  
pointing device 51 is, for example, a mouse. The data  
30          processing apparatus 1 further has an input/output  
controller 13, a data management unit 14, an area  
management unit 15, a display data generating unit 16,  
an image memory 17, a detecting unit 18, a deleting  
unit 19 and a working memory 20.

35          Data (e.g., character images and/or  
graphical images) is displayed on a screen of the  
display unit 50. The pointing device 51 points to

1 positions on the screen of the display unit 50. The  
keyboard 52 is used to input information to the data  
processing apparatus by a user. The input/output  
control unit 13 performs an interface process for the  
5 display unit 50, the pointing device 51 and the  
keyboard 52.

The data management unit 14 manages data to  
be displayed on the screen of the display unit 50.  
The area management unit 15 manages area information  
10 indicating an area in which the data managed by the  
data management unit 14 should be displayed on the  
screen of the display unit 50.

The display data generating unit 16  
generates data (e.g., character images and/or  
15 graphical images) to be displayed on the screen of the  
display unit 50 using the data managed by the data  
management unit 14 and the area information managed by  
the area management unit 15. The data generated by  
the display data generating unit 16 is expanded on the  
20 image memory 17. The data expanded on the image  
memory 17 is displayed on the screen of the display  
unit 50. The detecting unit 18 detects, with  
reference to areas managed by the area management unit  
15, an area including a position which is pointed to  
25 by the pointing device 51 on the screen of the display  
unit 50.

The deleting unit 19 performs a process for  
deleting data within the area detected by the  
detecting unit 18. In this process, the data (e.g.,  
30 character images and/or graphic images) is deleted as  
if the data was convergently being sucked at a  
position pointed to by the pointing device 51. The  
working memory 20 is used for the process performed by  
the deleting unit 19.

35 The deleting unit 19 has a first specifying  
block 21, a first density control block 22, a first  
speed control block 23 and a completion data output



1 block 24. The first specifying block 21 specifies  
data which should be deleted from the screen of the  
display unit 50 as if the data was convergently being  
sucked at a position. The first density control block  
5 22 controls the density of data displayed on the  
screen of the display unit 50 so that the density is  
gradually decreased in accordance with the convergent  
suction of the data. The first speed control block 23  
controls the speed at which the data is convergently  
10 sucked at the position on the screen of the display  
unit 50, in accordance with the convergent suction of  
the data. The completion data output block 24 causes  
completion data to be displayed at a position near the  
position into which the data is convergently sucked,  
15 when the process of the convergent suction of the data  
is completed.

The display data generating unit 16 has a  
restoring unit 25 and an exclusion unit 27. The  
restoring unit 25 restores the data which was deleted  
20 from the screen of the display unit 50 by the deleting  
unit 19. The data is restored on the screen of the  
display unit 50 so as to well up from a position  
pointed by the pointing device 51. A setting unit 26  
sets information indicating a type (e.g., graphics,  
25 text or the like) of data in accordance with an  
instruction input from the keyboard 52. The exclusion  
unit 27 excludes the type, indicated by information  
set by the setting unit 26, of data from the data  
which should be restored by the restoring unit 25.

30 The restoring unit 25 has a second  
specifying block 28, a second density control block 29  
and a second speed control block 30. The second  
specifying block 28 specifies data which is to be  
restored on the screen of the display unit 50. The  
35 second density control portion 29 controls the density  
of data which is being restored so that the density is  
gradually increased in accordance with appearance of

1 the restored data. The second speed control portion  
30 controls a speed at which the data wells up from  
the position pointed to by the pointing device 51, in  
accordance with appearance of the restored data.

5 In the data processing apparatus 1 having  
the above structure, the detecting unit 18 detects an  
area including a position pointed to (pointed  
position) by the pointing device 51 on the screen of  
the display unit 50. The deleting unit 19 then  
10 deletes data within the detected area, out of the data  
expanded on the image memory 17, from the screen of  
the display unit 50 using the working memory 20 as if  
the data was convergently being sucked at the pointed  
position.

15 While the data is being deleted as if the  
data was convergently being sucked, the first density  
control block 22 of the deleting unit 19 controls the  
density of remaining data which has been not yet  
deleted from the screen so that the density is  
20 gradually decreased in accordance the convergent  
suction of the data. The first speed control block 23  
of the deleting unit 19 controls the speed at which  
the data is convergently sucked in accordance with the  
convergent suction of the data. When the data is  
25 completely deleted, the completion data output block  
24 causes the completion data (e.g., an image of a  
column of smoke) to be displayed at a position near  
the position into which the data has been convergently  
sucked.

30 When a request for restoration of the data  
which was deleted by the deleting unit 19 is received  
by the restoring unit 25, the restoring unit 25  
restores, on the screen of the display unit 50, the  
data which was deleted so that the data wells up from  
35 the position pointed to by the pointing device 51.  
While the data is being restored so as to well up, the  
second density control block 29 of the restoring unit

1     25 controls the density of the data restored on the  
screen so that the density is gradually increased in  
accordance with appearance of the data. The second  
speed control block 30 of the restoring unit 25  
5     controls the speed at which the data wells up on the  
screen in accordance with the appearance of the data.

According to the data processing apparatus 1  
as described above, while the data (such as character  
images and/or graphical images) is being deleted as if  
10    the data was convergently being sucked at a position  
on the screen of the display unit 50, the density of  
the remaining data is gradually decreased in  
accordance with the convergent suction of the data.  
The speed at which the data is convergently sucked is  
15    controlled in accordance with the convergent suction  
of the data. Further, while the data is being  
restored as if the data was welling up from a position  
on the screen of the display unit 50, the density of  
the data is gradually increased in accordance with the  
20    appearance of the data. The speed at which the data  
wells up is controlled in accordance with the  
appearance of the data. Thus, the data can disappear  
and appear from the screen of the display unit 50 in a  
more friendly manner to the user.

25       The data processing apparatus as described  
above may be formed, for example, using a general  
purpose computer system (e.g., a personal computer).  
In this case, the computer system has hardware as  
shown in Fig. 2. Referring to Fig. 2, the computer  
30    system 100 has the display unit 50, the pointing  
device 51, such as a mouse, and the keyboard 52. The  
computer system 100 further has a controller 54, a  
hard disk unit 53 (HD), a memory unit 55 and a floppy  
disk drive unit 56 (FDD).

35       The controller 54 includes a CPU (Central  
Processing Unit) which performs various processes  
corresponding to the functions of the data processing

1 apparatus as described above. The hard disk unit 53  
stores data files which may be processed in the  
computer system 100. Application programs may be  
stored in the hard disk unit 53. The memory unit 55  
5 includes an image memory, a working memory and various  
types of memories (a RAM and a ROM) for storing data  
and programs. The floppy disk drive 56 drives a  
floppy disk (FD) loaded therein, and data read out  
from the floppy disk (FD) is supplied from the floppy  
10 disk drive unit 56 to the controller 54. A program  
corresponding to the functions of the data processing  
apparatus described above is supplied as a part of an  
application program, such as a word-processing  
application program or a graphic processing  
15 application program, to this computer system 100 from  
floppy disks. The application program read out from  
the floppy disks by the floppy disk drive unit 56 is  
installed into the hard disk unit 53 under the control  
of the controller 54. The CPU in the controller 54  
20 executes processes in accordance with the application  
program using a predetermined memory (a RAM) in the  
memory unit 55. As a result, for example, a file  
stored in the hard disk unit (HD) 53 is opened, and  
data (e.g., character images and/or graphical images)  
25 on a page of the opened file is then displayed on the  
screen of the display unit 50.

A user inputs a "deletion request" using the  
keyboard 52 to delete data on the page of the opened  
file. In response to the "deletion request", the CPU  
30 of the controller 54 starts a process in accordance  
with a procedure shown in Fig. 3.

Referring to Fig. 3, the CPU is waiting for  
an input operation in step S1. When the CPU detects  
that an input operation is performed, the CPU  
35 determines, in step S2, whether or not the input  
operation is an operation for setting a window on the  
screen of the display unit 50. If the operation for

1     setting a window on the screen of the display unit 50  
is performed, the CPU waits for an input operation  
again, in step S3. When the CPU detects that an input  
operation is performed, the CPU determines, in step  
5     S4, whether or not the input operation is an operation  
for pointing to a position on the screen of the  
display unit 50 using the pointing device 51. If the  
operation for pointing to a position on the screen of  
the display unit 50 is performed, the CPU detects  
10    (recognizes) the pointed position in step S5. The CPU  
then sets, in step S6, data within the window  
including the pointed position as data to be deleted.

      If neither the operation for setting the  
window nor the operation for pointing to the position  
15    is performed, it is further determined, in step S11,  
whether or not an operation for canceling the process  
in response to the "deletion request" has been  
performed. If the operation for canceling the process  
has been performed, the process is interrupted. On  
20    the other hand, if the input operation is not the  
operation for canceling the process, the CPU further  
waits for the operation for setting the window and/or  
the operation for pointing to the position (in steps  
S1 and S3).

25       If a position is pointed before the  
operation for setting a window is performed, all data  
within the screen of the display unit 50 is set as  
data to be deleted in step S6.

      After the data to be deleted is set as  
30    described above, the CPU starts steps for deleting the  
data. In step S7, elements of the data (e.g.,  
characters of a character image, image blocks of  
graphical image, pixels of an image or the like)  
within the specified window are thinned in accordance  
35    with a predetermined rule. Remaining elements in the  
window are then moved toward the pointed position  
convergently so as to be close to each other. As a

1 result, reduced data (a reduced image) is formed of  
the remaining elements. The reduced data is set as  
new data to be deleted. The CPU then causes the  
density of the reduced data to be decreased by one  
5 rank, in step S8. For example, the number of colored  
dots (e.g., black dots) included in the elements  
forming the reduced data is decreased by one rank in  
accordance with a predetermined rule.

After this, the CPU determines, in step S9,  
10 whether or not all the elements of the data in the  
window have been deleted. If all the elements in the  
window have not yet been deleted, the process returns  
to step S7. After this, steps S7 and S8 are  
repeatedly executed until all the elements in the  
15 window are deleted. If the CPU determines, in step  
S9, that all the elements in the window have been  
deleted, the CPU causes the display unit 50 to display  
a column of smoke (meaning that all the data have been  
completely deleted) at a position near the pointed  
20 position on the screen, in step S10.

While step S7 is repeatedly being executed,  
the data (the image) within the specified window is  
reduced and deleted, for example, in accordance with a  
rule as shown in Fig. 4A.

25 Referring to Fig. 4A, data to be deleted is  
formed of elements arranged in a matrix. Every time  
step S7 is executed, elements on odd lines (1, 3,  
5, ...) in row and column directions are deleted. The  
remaining elements (indicated by  $\otimes$ ) are then  
30 convergently moved toward the pointed position so as  
to be close to each other. As a result, while step S7  
is repeatedly being executed, the data (e.g., a  
character image) is gradually reduced as if the data  
was being sucked at the pointed position, as shown in  
35 Fig. 4B. Finally, the data is completely deleted from  
the screen of the display unit 50.

In a case where a position Po is pointed to

1 in a window W as shown in Fig. 5, the elements of the data in the window W are thinned as follows.

When the position  $P_0$  is pointed to in the window W, the window W is divided into areas  $E_1 (X_A \times Y_A)$ ,  $E_2 (X_B \times Y_A)$ ,  $E_3 (X_A \times Y_B)$  and  $E_4 (X_B \times Y_B)$ . While the elements arranged in the row direction (X) in each of the areas  $E_2$  and  $E_4$  are being repeatedly thinned the number  $X_B$  of times, the elements arranged in the row direction (X) in each of the areas  $E_1$  and  $E_3$  are being repeatedly thinned the number  $X_A$  of times. In addition, while the elements arranged in the column direction (Y) in each of the areas  $E_1$  and  $E_2$  are being repeatedly thinned the number  $Y_A$  of times, the elements arranged in the column direction (Y) in each of the areas  $E_3$  and  $E_4$  are being repeatedly thinned the number  $Y_B$  of times. According to the above manner in which the elements in the respective areas  $E_1$ ,  $E_2$ ,  $E_3$  and  $E_4$  are deleted, the elements in the respective areas  $E_1$ ,  $E_2$ ,  $E_3$  and  $E_4$  are approximately simultaneously deleted.

A step for pivoting reduced data obtained in step S7 about the pointed position by a predetermined angle may be added after step S7 or S8. In this case, the elements of the data can be moved toward the pointed position as if the elements were spirally sucked at the pointed position.

The elements can be also moved spirally in a manner as shown in Fig. 6. In this case, every time an element in contact with a predetermined side of the pointed position  $P_0$  is deleted, the elements are spirally moved toward the pointed position  $P_0$ .

As has been described above, in response to the "deletion request", the elements of the data in the specified window on the screen of the display unit 50 are deleted as if the elements were convergently sucked at the pointed position in the specified window. Further, while elements are being deleted so

1 that the data is reduced, the density of the reduced  
data is gradually decreased in accordance with the  
suction of the elements. Thus, the data can be  
deleted from the screen of the display unit 50 as if  
5 the data was realistically sucked at a point.

In the process shown in Fig. 3, steps shown  
in Fig. 7 may be added after step S8 or substituted  
for step S8. In the following embodiment, for  
example, steps shown in Fig. 7 are substituted for  
10 step S8 shown in Fig. 3. Due to a process of steps  
shown in Fig. 7, the speed at which the elements of  
the data are deleted is increased in accordance with a  
degree of deletion of the elements.

After the reduced data is obtained in step  
15 S7 shown in Fig. 3, the CPU starts a process of steps  
shown in Fig. 7. Referring to Fig. 7, the CPU reads a  
count value  $i$  of an internal counter in step S21. The  
internal counter has already been initialized at "0".  
The CPU determines, in step S22, whether the count  
20 value  $i$  is less than a first reference value  $i_0$   
( $i < i_0$ ). If the count value  $i$  is less than the first  
reference value  $i_0$ , a delay timer having a first delay  
time (1) is activated in step S23. After the first  
delay time (1) elapses, the CPU causes the count value  
25  $i$  of the internal counter to increment by one ( $i \rightarrow i+1$ )  
in step S24. After this, step S9 shown in Fig. 3 is  
executed.

Until the count value  $i$  of the internal  
counter reaches the first reference value  $i_0$ , step S7  
30 shown in Fig. 3 and steps S21, S22, S23 and S24 shown  
in Fig. 7 are repeatedly executed. As a result, a  
process for reducing the data in step S7 is repeatedly  
executed at first intervals each of which corresponds  
to the first delay time (1).

35 When the count value  $i$  of the internal  
counter reaches the first reference value  $i_0$ , the CPU  
further determines, in step S25, whether the count



1 value  $i$  of the internal counter is within a range  
between the first reference value  $i_0$  and a second  
reference value  $i_1$  greater than the first reference  
value  $i_0$  ( $i_0 \leq i < i_1$ ). If the count value  $i$  is within  
5 the range ( $i_0 \leq i < i_1$ ), a delay timer having a second  
delay time (2) is activated in step S26. The second  
delay time (2) is less than the first delay time (1)  
described above. After the second delay time (2)  
elapses, the CPU causes the count value  $i$  of the  
10 internal counter to increment by one ( $i \rightarrow i+1$ ) in step  
S24. In this case, until the count value  $i$  of the  
internal counter reaches the second reference value  
 $i_1$ , step S7 shown in Fig. 3 and steps S21, S22, S25,  
S26 and S24 are repeatedly executed. As a result, the  
15 process for reducing the data in step S7 is repeatedly  
executed at second intervals each of which corresponds  
to the second delay time (2). Since the second  
intervals corresponding to the second delay time (2)  
are less than the first intervals corresponding to the  
20 first delay time (1), the speed at which the data is  
reduced (the elements of the data are deleted) is  
increased.

Further, if the count value  $i$  exceeds the  
second reference value  $i_1$  ( $i > i_1$ ), the steps S7 is  
25 executed every time the count value  $i$  is incremented  
by one without a delay time. As a result, the speed  
at which data is reduced (the element of the data are  
deleted) is further increased.

According to the above process, the speed at  
30 which the elements of the data are deleted is  
gradually increased in accordance with the degree of  
the deletion of the elements. Thus, it appears that  
the elements (e.g., characters) of the data (e.g., a  
character image) can be more really sucked at the  
35 pointed position convergently.

A user inputs a "restoration request" using  
the keyboard 52 to restore data which was deleted. In

1 response to the "restoration request", the CPU of the  
controller 54 starts a process in accordance with a  
procedure shown in Fig. 8.

Referring to Fig. 8, the CPU is waiting for  
5 an input operation in step S31. If the input  
operation is performed, the CPU further determines, in  
step S32, whether the input operation is an operation  
for specifying data to be restored. If the operation  
for specifying data to be restored is performed, the  
10 CPU sets the data to be restored in the working memory  
in step S33. After this, the CPU is waiting an input  
operation again in step S34. If an input operation is  
performed, the CPU further determines, in step S35,  
whether the input operation is an instruction of an  
15 exclusion operation. The exclusion operation is an  
operation for excluding a type of data (e.g., a  
graphical image, a character image, and/or a numeral  
image) from the data which has been set as the data to  
be restored. If the instruction of the exclusion  
20 operation is input, the CPU executes the exclusion  
operation, in step S36, so that one or a plurality of  
types of data are excluded from the data to be set as  
the data to be restored. After this, the CPU is  
waiting for an input operation again in step S37. If  
25 an input operation is performed, the CPU determines,  
in step S38, whether the input operation is an  
operation for pointing to a position on the screen of  
the display unit 50 using the pointing device 51. If  
the operation for pointing to a position is performed,  
30 the CPU detects (recognizes) the pointed position in  
step S39.

If the exclusion operation is not performed,  
all the data initially specified by the user is set as  
the data to be restored. In addition, if the CPU  
35 determines, in steps S43, that an operation for  
canceling the process has been performed, the CPU ends  
the process.

1           After the CPU detects (recognizes) the  
pointed position in step S39, the CPU starts a process  
for restoring the data on the screen of the display  
unit 50. In step S40, elements are selected from the  
5   data to be restored in accordance with a rule  
inversely related to the rule in which the elements of  
the data to be deleted are thinned as described above  
(see Fig. 4A). The selected elements are rearranged  
and displayed so as to be close to each other at  
10   positions including the pointed position on the screen  
of the display unit 50. The displayed elements are  
expanded on the screen of the display unit 50 in  
accordance with a rule inversely related to the rule  
in which the elements are moved toward the selected  
15   point so as to move close to each other to form the  
reduced data as described above (see Figs. 4A and 4B).  
Step S40 is executed once, so that the data is  
partially restored on the screen of the display unit  
50. Data formed of the elements which are expanded is  
20   referred to, for example, as sparse data. The sparse  
data obtained in step S40 has a density (initially at  
a minimum value).

          In step S41, the CPU causes the density of  
the sparse data obtained in step S40 to be increased  
25   by one rank. For example, the number of colored dots  
(e.g., black dots) included in each of the elements of  
the sparse data is increased by one rank in accordance  
with a predetermined rule. After this, the CPU  
determines, in step S42, whether all the elements of  
30   the data set as the data to be restored are restored  
on the screen of the display unit 50. If there are  
elements to be restored, the process returns to step  
S40.

          In step S40 at this time, elements are  
35   selected from the data to be restored in accordance  
with the rule described above. The selected elements  
are then added to the sparse data so that all elements

1 are close to each other. All the elements are  
expanded in accordance with the rule described above  
so that new sparse data is obtained. After this, in  
step S41, the density of the sparse data is increased  
5 by one rank in the manner described above. Until all  
elements of the data set as the data to be restored  
are restored, the process in steps S40 and S41 is  
repeatedly executed. As a result, the elements of the  
data are restored on the screen of the display unit 50  
10 as if the elements welled up from the pointed  
position. The density of the data restored on the  
screen of the display unit 50 is gradually increased  
in accordance with increasing of the number of  
elements forming the data restored on the screen.

15 According to the above process in response  
to the "restoration request" from the user, the data  
is restored on the screen of the display unit 50 as if  
the data welled up from the pointed position.  
Further, while the data is being restored, the density  
20 of the data is gradually increased in accordance with  
the appearance of the data. Thus, the data (e.g., a  
character image and/or a graphical image) can be  
restored on the screen of the display unit 50 as if  
the data well up realistically.

25 The elements of the data may be restored on  
the screen in a rule which is inversely related to the  
rule in which the elements are spirally deleted as  
described above (e.g., the rule illustrated in Fig.  
6). In this case, the elements of the data are  
30 restored on the screen of the display unit 50 as if  
the elements spirally welled up from the pointed  
position.

In addition, the elements of the data may be  
restored on the screen in a rule which is inversely  
35 related to the rule illustrated in Fig. 5. In this  
case, the elements of the data are restored on the  
screen as if the elements radially welled up from the

1 pointed position.

In the process shown in Fig. 8, steps shown in Fig. 9 may be added after step S41 or substituted for step S41. In the following embodiment, for example, steps shown in Fig. 9 are substituted for step S41 shown in Fig. 8. Due to a process of steps shown in Fig. 9, the speed at which the elements of the data are restored is decreased in accordance with a degree of restoration of the elements.

10 After the sparse data is obtained in step S40 shown in Fig. 8, the CPU starts a process of steps shown in Fig. 9. Referring to Fig. 9, the CPU reads a count value  $i$  of an internal counter in step S51. The internal counter has been already initialized at "0".  
15 The CPU determines, in step S52, whether the count value  $i$  is less than a first reference value  $i_0$  ( $i < i_0$ ). If the count value  $i$  is less than the first reference value  $i_0$ , the count value  $i$  is incremented by one ( $i \rightarrow i+1$ ) in step S53. After this, step S42 shown in Fig. 8 is executed.

Until the count value  $i$  of the internal counter reaches the first reference value  $i_0$ , step S40 shown in Fig. 8 and steps S51, S52 and S53 shown in Fig. 9 are repeatedly executed. As a result, a  
25 process for restoring the data in step S40 is repeatedly executed at short intervals.

When the count value  $i$  of the internal counter reaches the first reference value  $i_0$ , the CPU further determines, in step S54, whether the count value  $i$  of the internal counter is within a range between the first reference value  $i_0$  and a second reference value  $i_1$  greater than the first reference value  $i_0$  ( $i_0 \leq i < i_1$ ). If the count value  $i$  is within the range ( $i_0 \leq i < i_1$ ), a delay timer having a second  
30 delay time (2) is activated in step S55. After the second delay time (2) elapses, the CPU causes the count value  $i$  of the internal counter to increment by

1 one ( $i \rightarrow i+1$ ) in step S53. In this case, until the  
count value  $i$  of the internal counter reaches the  
second reference value  $i_1$ , step S40 shown in Fig. 8  
and steps S51, S52, S54, S55 and S53 are repeatedly  
5 executed. As a result, the process for restoring the  
data in step S40 is repeatedly executed at second  
intervals each of which corresponds to the second  
delay time (2). Since the intervals at which the  
process for restoring the data in step S40 is  
10 repeatedly executed lengthen, the speed at which the  
elements of the data are restored is decreased.

Further, if the count value  $i$  exceeds the  
second reference value  $i_1$  ( $i > i_1$ ), a delay timer having  
a first delay time (1) is activated in step S56. The  
15 first delay time (1) is greater than the second delay  
time (2) described above. After the first delay time  
(1) elapses, the CPU causes the count value  $i$  of the  
internal counter to increment by one ( $i \rightarrow i+1$ ) in step  
S53. In this case, step S40 shown in Fig. 8 and steps  
20 S51, S52, S54, S56 and S53 are repeatedly executed.  
As a result, the process for restoring the data in  
step S40 is repeatedly executed at first intervals  
each of which corresponds to the first delay time (1).  
Since the first intervals corresponding to the first  
25 delay time (1) are greater than the second intervals  
corresponding to the second delay time (2), the speed  
at which the elements of the data are restored is  
further decreased.

According to the above process, the speed at  
30 which the elements of the data are restored is  
gradually decreased in accordance with the increasing  
of the number of elements restored on the screen.  
Thus, the elements (e.g., characters) of the data  
(e.g., a character image) can be restored on the  
35 screen as if the elements realistically welled up from  
the pointed position.

In the first embodiment as described above,

1 the data processing apparatus is formed using the  
general purpose computer. However, the present  
invention is not limited to this. The data processing  
apparatus according to the present invention may be  
5 formed using a portable remote computer terminal and  
other types of computers.

A description will now be given of a second  
embodiment of the present invention.

10 A data processing apparatus according to the  
second embodiment of the present invention is  
functionally formed as shown in Fig. 10. Referring to  
Fig. 10, the data processing apparatus 2 has a display  
unit 40, a pointing device 41 and an input/output  
control unit 42. The data processing apparatus 2  
15 further has a menu item management unit 43, a  
determination unit 44, a display control unit 45, a  
detecting unit 46 and a selecting unit 47.

20 The display unit 40 is formed, for example,  
using a LCD (Liquid Crystal Display) panel. The  
pointing device 41 is used to point to positions on a  
screen of the display unit 40. The input/output  
control unit 42 performs interface processes for the  
display unit 40 and the pointing device 41.

25 The menu item management unit 43 manages  
menu items which are to be displayed on the screen of  
the display unit 40. The determination unit 44  
determines whether or not an instruction for  
displaying menu items has been issued. The display  
control unit 45 causes menu items managed by the menu  
30 item management unit 43 to be displayed on the screen  
of the display unit 40 one by one in turns. The  
detecting unit 46 detects that a pointing operation  
using the pointing device 41 is interrupted. The  
selecting unit 47 selects a menu item to be activated.

35 In the data processing apparatus which is  
functionally configured as described above, the  
following processes are formed.

1           When the determination unit 44 determines  
that an instruction for displaying menu items has been  
issued, the display control unit 45 causes the menu  
items managed by the menu item management unit 43 to  
5   be displayed in an area including a position pointed  
to by the pointing device 41 on the screen of the  
display unit 40 one by one in turns. In this state,  
when the detecting unit 46 detects that the pointing  
operation using the pointing device 41 has been  
10   interrupted, the selecting unit 47 selects a menu item  
which is displayed at this time as an item to be  
activated.

          According to the data processing apparatus  
of the second embodiment of the present invention as  
15   described above, in response to the pointing operation  
using the pointing device 41, the menu items are  
displayed on the screen of the display unit 40 one by  
one in turns. In response to interruption of the  
pointing operation, a single menu item to be activated  
20   is selected. Since all the menu items which can be  
selected are not simultaneously displayed on the  
screen, an area in which the menu items are displayed  
on the screen can be narrowed. In addition, an  
operation for selecting a menu item from among a  
25   plurality of menu items can be simplified. Thus, a  
plurality of menu items can be displayed on a limited  
area of the display screen so as to be easily selected  
by a user.

          The data processing apparatus according to  
30   the second embodiment of the present invention as  
described above may be formed, for example, using a  
portable remote computer terminal. In this case, the  
computer system has hardware as shown in Fig. 11.  
Referring to Fig. 11, the computer system 200 has a  
35   display unit 50 such as an LCD (Liquid Crystal  
Display) panel and a pointing device 51 such as a pen-  
touch input device. The computer system 200 further



1 has a controller 57 and a memory unit 58.

The controller 57 includes a CPU (Central Processing Unit) which performs various processes corresponding to the functions of the data processing apparatus as described above. The memory unit 58 includes various types of memories, such as a RAM, a ROM and a memory card (a ROM card and/or a RAM card), for storing various types of data and programs. A menu file used to manage menu items to be displayed on the screen of the display unit 50 is stored in a memory included in the memory unit 58.

A program corresponding to the functions of the data processing apparatus described above has been previously installed in the ROM of the memory unit 56. The program may be supplied as a part of an application program, such as a word-processing application program, to the portable remote computer terminal (the computer system 200) using a ROM card. The CPU in the controller 57 executes processes in accordance with the program, stored in the memory unit 58, corresponding to a procedure shown in Fig. 12.

Referring to Fig. 12, the CPU causes a menu bar to be displayed on the screen of the display unit 50 in step S60. The menu bar is formed, as shown in Fig. 13, of menus (EDIT, PRINT, FILE, GRAPHICS and TOOL). Menu items included in the respective menus (EDIT, PRINT, FILE, GRAPHICS and TOOL) in the menu bar are managed in the menu file stored in the memory unit 58. For example, the menu "EDIT" includes menu items "MOVE", "COPY", "INSERT", "DELETE", etc. In a state where the menu bar is displayed on the screen of the display unit 50, the CPU is waiting for a pointing operation for pointing to one of menus in the menu bar in step S61. This pointing operation means an instruction for displaying menu items. A user performs the pointing operation which points to, for example, a menu "EDIT" in the menu bar using the

1 pointing device 51. In response to the pointing  
operation, the CPU reads out a first menu item "MOVE"  
of the menu pointed to (pointed menu) "EDIT" from the  
menu file in the memory unit 58. Only the first menu  
5 item "MOVE" is then displayed at the position pointed  
to by the pointing device on the screen of the display  
unit 50 in step S62.

After this, the CPU causes an internal timer  
to be reset to "0" ( $T=0$ ) and to start in steps S63 and  
10 S64. The CPU then determines, in step S65, whether or  
not the pointing operation is interrupted, that is,  
whether or not the pointing device 51 (a touch-pen) is  
separated from the screen of the display unit 50.  
After this, the CPU further determines, in step S66,  
15 whether or not a timer value  $T$  of the internal timer  
reaches a reference value  $T_0$ . Until the timer value  $T$   
reaches the reference value  $T_0$ , the CPU is repeatedly  
determining, in step S65, whether or not the pointing  
operation is interrupted. If the timer value  $T$   
20 reaches the first reference value  $T_0$  ( $T \geq T_0$ ) before the  
pointing operation is interrupted, the CPU causes the  
menu item displayed on the screen to be changed from  
the first menu item "MOVE" to the second menu item  
"COPY" in step S67.

25 After the displayed menu item is changed,  
the internal timer is reset to "0" and starts in the  
same manner as described above (steps S63 and S64).  
The CPU then determines, in step S65, whether or not  
the pointing operation is interrupted. After this,  
30 the same process (in steps S66, S67, S63, S64 and S66)  
is repeated until the CPU determines that the pointing  
operation is interrupted. During this process, the  
displayed menu item is changed one by one in turns  
("MOVE"  $\rightarrow$  "COPY"  $\rightarrow$  "INSERT"  $\rightarrow$  "DELETE"  $\rightarrow$  ...  $\rightarrow$  "MOVE"  
35  $\rightarrow$  ...) at intervals each of which corresponds to the  
reference value  $T_0$ .

For example, when the pointing operation is

1 interrupted, that is, when the pointing device 51 is  
separated from the screen of the display unit, the CPU  
causes a menu item which is displayed at this time to  
be selected in step S68. As a result, the CPU  
5 recognizes that an instruction corresponding to the  
selected menu item has been received.

The data processing apparatus according to  
the second embodiment of the present invention is  
formed in the portable remote computer terminal.  
10 However, the present invention is not limited to this.  
The processing apparatus having the functions  
described in the second embodiment may be formed in a  
general purpose computer (e.g., a personal computer).

The present invention is not limited to the  
15 aforementioned embodiments, and other variations and  
modifications may be made without departing from the  
scope of the claimed invention.

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